Chapter 3

Health and political factors[11]

3.1 Introduction

Various scholars claim that particular political variables are related to cross-country differences in population health. For instance, Besley and Kudamatsu (2006) explore the link between democracy and health using panel data from a cross-section of countries and report a strong (conditional) correlation between life expectancy and democracy. In stark contrast, Ross (2006) argues that most cross-national studies omit from their samples non-democratic states with good economic and social records, which creates the false impression that democracies have outperformed non-democracies. Correcting for this, Ross finds that democracy has little or no effect on infant and child mortality.

Moreover, it is widely believed that poor governance causes well-intentioned spending to have no impact due to bribes, corrupt officials, and mis-procurement. Indeed, the scant available evidence suggests that poor governance has a negative impact on health. Menon-Johansson (2005) concludes that HIV prevalence is significantly associated with poor governance, while Lazarova and Mosca (2007) report that governance – proxied by the indicators of Kaufmann *et al.* (2007) – is related to life expectancy of the population.

Most empirical studies on the relationship between political institutions and cross-country differences in health have various shortcomings. First, authors generally do not carefully decide on their model specification and fail to examine how sensitive their results are with respect to sample selection. This implies that a particular variable may be significant in a particular model, but can become insignifi-

[11] This chapter is based on Klomp and De Haan (2008; 2009a; 2009b)

cant in another specification that may also be justified on theoretical grounds. The conclusions of most previous studies may be questioned as they only take a few control variables into account. For instance, they do not consider the relationship between political factors and (the quality of) the health care sector, while this is arguably a key variable in explaining differences in health across countries. Likewise, a variable may be significant for a particular group of countries but may become insignificant when a different sample is used. Second, most studies that rank countries on the basis of their health status use the life expectancy or the mortality rate as indicator of the health status of a country, thereby implicitly assuming that health is a one-dimensional concept (cf. Charlton *et al.* 1983; Nolte and McKee, 2003; 2008). However, this is not in line with the definition of health of the WHO, according to which health is "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity. Health is a resource for everyday life, not the object of living, and is a positive concept emphasizing social and personal resources as well as physical capabilities". This definition suggests that health is a multi-faceted concept.

Nowadays, there is much information available on national health. The question is how all this information should be combined? What is the appropriate conceptual framework for measuring health (Cutler *et al.*, 1997)? In this chapter we first apply (static) factor analysis on various national health indicators for 171 countries over the period 2000 to 2005 to examine whether health has more than one dimension. We use the outcomes of the factor analysis to construct two new health measures. The first one refers to the health of individuals and the second measure captures the quality of the health care sector. We subsequently use these measures to examine the relationship between political factors and health in a cross-country structural equation model with various economic and demographic control variables. We use 3 different (sets of) political system indicators, i.e., the type of regime, the stability of the political system and governance. To ensure that our work does not suffer from an omitted variable bias, we take a long list of potential control variables into account, as suggested by previous studies. We decide on the specification of our model using the general-to-specific approach as proposed by Campos *et al.* (2004). This is a highly recommended way of deciding on model specification in case there are many potential control variables.

3.2 Measurement of health

Studies examining the link between political institutions and health as summarized in Table A3.1 of Appendix A3 often use health indicators that are chosen in a rather arbitrary way. We apply factor analysis on 19 national indicators of the health of individuals for 171 countries. Many of these variables have been used in previous studies. We include variables on the basis of their availability for a large sample of countries. Table A3.2 lists all countries included in the various factor analyses.

Our data come from the World Health Organisation (WHO) and the World Bank. We apply factor analysis on 19 national indicators of the health of individuals. The indicators used and their sources are given in Table 3.1.

Table 3.1 Indicators of the health of individuals

Lifetime:	Source
Healthy life expectancy	WHO (2007)
Life expectancy at birth	World Bank (2006)
Mortality rate adults	World Bank (2006)
Mortality rate under-5	World Bank (2006)
Mortality rate infants	World Bank (2006)
Years lost to communicable diseases	WHO (2007)
Years lost to non-communicable diseases	WHO (2007)
Years lost to injuries	WHO (2007)
Age standardized mortality rate: cardiovascular diseases	WHO (2007)
Age standardized mortality rate: cancer	WHO (2007)

Diseases and sickness:	Source
Prevalence rate HIV	World Bank (2006)
Prevalence rate Tuberculosis	WHO (2007)
Prevalence rate ARI	WHO (2007)
Prevalence rate Undernourished children	World Bank (2006)
Prevalence rate Diarrhea	World Bank (2006)
Prevalence rate Diphtheria	WHO (2007)
Prevalence rate Measles	WHO (2007)
Prevalence rate Tetanus	WHO (2007)
Prevalence rate Polio	WHO (2007)

We use averages over the period 2000 to 2005 for 171 countries, giving 3249 observations[12]. For some countries one or two indicators are not available, yielding 152 missing observations, which is less than 5 percent. In order not to lose valuable information, we applied the EM algorithm to compute the missing observations.

As can be seen from Table 3.2, the correlations between the different indicators are often quite low. Therefore, we consider the different indicators of individual health as imperfect measures of this concept.

To extract the right number of factors out of the various indicators, the scree plot is used (see Figure 3.1). According to the Kaiser rule, two factors should be identified, while the elbow interpretation indicates only one factor. Both models have been compared using a likelihood ratio test. The two-factor model does not fit the data significantly better than the one-factor model. The likelihood ratio test statistic for the one-factor model is 294,87, which is $\chi^2(152)$ distributed and is highly significant (compared to a satured model) at the five percent significance level, suggesting that the one-factor model is appropriate.

Figure 3.1 Scree plot of the health of individuals

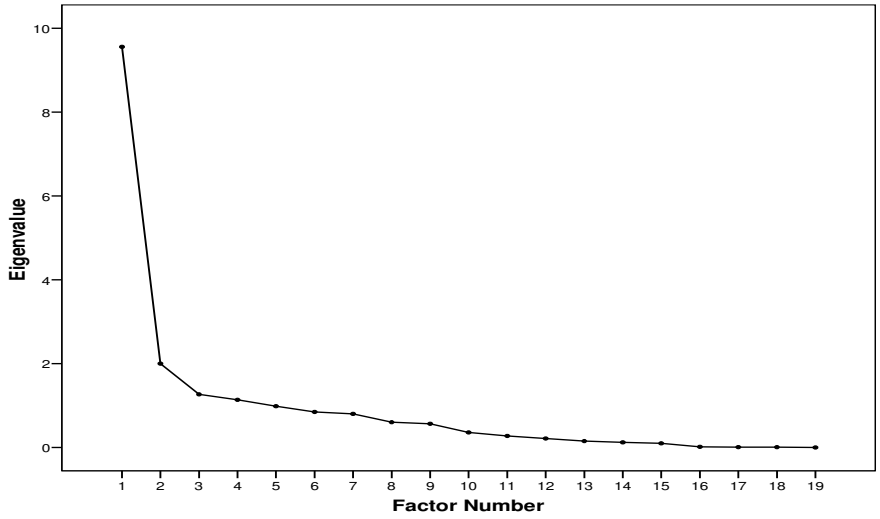


Table 3.3 presents the factor loading of the various national indicators of the health of individuals and the variance of the indicators explained by the first factor. More than seventy percent of the variance is explained by the first factor and about thirty

[12] Only countries with a population larger then 200,000 are taken into account. Furthermore, countries are only included if there are three or more observations between 2000 and 2005.

percent of the total variance is unique. The one factor model can explain almost the total variance of healthy life expectancy, but less than 10 percent of the age standardized mortality of cancer and the Tetanus prevalence rate.

Next, we apply factor analysis on 10 national indicators of the quality of the health care sector. The indicators used and their sources are given in Table 3.4. Here we also use averages over the period 2000 to 2005 for 171 countries. So there are 1710 observations. For some countries one or two indicators are not available. We have 83 missing observations, which is less than 5 percent. Also in this case the various indicators are imperfect substitutes as shown by their correlations presented in Table 3.5.

Table 3.2 Correlation matrix: indicators of the health of individuals

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Healthy life expectancy	(1)	1.00	0.98	-0.93	-0.93	-0.93	-0.93	0.92	0.53	-0.54	-0.20	-0.59	-0.85	-0.39	-0.76	-0.64	-0.21	0.11	-0.01	0.02
Life expectancy at birth	(2)		1.00	-0.94	-0.91	-0.91	-0.93	0.90	0.57	-0.48	-0.23	-0.63	-0.87	-0.41	-0.74	-0.62	-0.22	0.09	-0.01	0.01
Mortality rate adults	(3)			1.00	0.81	0.81	0.85	-0.82	-0.53	0.41	0.24	0.80	0.82	0.40	0.65	0.51	0.19	-0.09	0.02	0.04
Mortality rate under-5	(4)				1.00	0.99	0.87	-0.85	-0.55	0.48	0.24	0.39	0.80	0.28	0.75	0.69	0.29	-0.07	0.09	-0.07
Mortality rate infants	(5)					1.00	0.88	-0.86	-0.54	0.53	0.21	0.40	0.80	0.28	0.77	0.69	0.24	-0.07	0.08	-0.07
Years lost to communicable diseases	(6)						1.00	-0.98	-0.59	0.36	0.12	0.54	0.82	0.44	0.76	0.68	0.22	-0.10	0.02	-0.12
Years lost to non-communicable diseases	(7)							1.00	0.42	-0.36	-0.10	-0.51	-0.80	-0.43	-0.74	-0.67	-0.23	0.09	-0.02	0.08
Years lost to injuries	(8)								1.00	-0.18	-0.13	-0.43	-0.52	-0.23	-0.48	-0.36	-0.09	0.10	0.02	0.22
Age standardized mortality: cardiovascular	(9)									1.00	-0.06	0.08	0.35	0.03	0.41	0.25	0.07	-0.09	0.01	0.23
Age standardized mortality: cancer	(10)										1.00	0.13	0.21	0.04	0.10	0.15	0.09	0.04	0.00	0.08
Prevalence rate HIV	(11)											1.00	0.58	0.34	0.33	0.19	0.02	-0.06	-0.06	-0.04
Prevalence rate Tuberculosis	(12)												1.00	0.39	0.69	0.53	0.21	-0.01	0.04	-0.01
Prevalence rate ARI	(13)													1.00	0.29	0.27	0.02	-0.05	-0.03	0.02
Prevalence rate Undernourished children	(14)														1.00	0.56	0.13	-0.09	-0.03	-0.09
Prevalence rate Diarrhea	(15)															1.00	0.18	-0.04	0.04	-0.08
Prevalence rate Diphtheria	(16)																1.00	0.90	0.57	0.07
Prevalence rate Measles	(17)																	1.00	0.23	0.14
Prevalence rate Tetanus	(18)																		1.00	0.42
Prevalence rate Polio	(19)																			1.00

Table 3.3 Factor matrix health of individuals

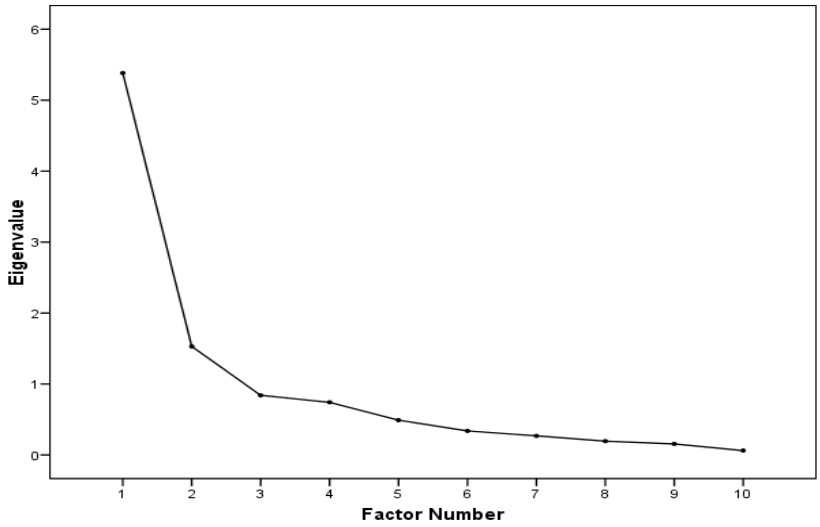
Indicator	Factor loadings	Variance explained
Healthy life expectancy	0.893	0.80
Life expectancy at birth	0.892	0.80
Mortality rate adults	-0.837	0.70
Mortality rate under-5	-0.838	0.70
Mortality rate infants	-0.841	0.71
Years lost to communicable diseases	-0.836	0.70
Years lost to non-communicable diseases	-0.818	0.67
Years lost to injuries	-0.554	0.31
Age standardized mortality rate: cardiovascular diseases	-0.514	0.26
Age standardized mortality rate: cancer	-0.211	0.04
Prevalence rate HIV	-0.603	0.36
Prevalence rate Tuberculosis	-0.860	0.74
Prevalence rate ARI	-0.402	0.16
Prevalence rate Undernourished children	-0.764	0.58
Prevalence rate Diarrhea	-0.647	0.42
Prevalence rate Diphtheria	-0.332	0.11
Prevalence rate Measles	-0.412	0.17
Prevalence rate Tetanus	-0.232	0.05
Prevalence rate Polio	-0.442	0.20

Table 3.4 Indicators of the health care sector

Staff	Source
Number of dentists per 1,000 people	WHO (2007)
Number of nurses per 1,000 people	WHO (2007)
Number of physicians per 1,000 people	World Bank (2006)
Number of pharmacists per 1,000 people	WHO (2007)
Births attended by skilled staff (% of total)	World Bank (2006)
Hospital beds per 1,000 people	World Bank (2006)

Immunization rate	
Immunization rate Measles	WHO (2007)
Immunization rate DTP	WHO (2007)
Immunization rate Hepatitis	WHO (2007)
Immunization rate Tuberculosis	WHO (2007)

Figure 3.2 Scree plot of the health care sector



The scree plot is shown in Figure 3.2. According to the Kaiser rule, two factors should be identified, while the elbow interpretation indicates only one factor. Both models have been compared using a likelihood ratio test. The two-factor model does not fit the data significantly better than the one-factor model. The likelihood ratio test statistic of the factor model is 438.98 which is $\chi^2(35)$ distributed and is highly significant at the five percent significance level, suggesting that the one-factor model is appropriate.

Table 3.6 presents the factor loadings of the various indicators and the variance of the indicators explained by the factor. About seventy of the variance is explained by the factor and about thirty percent of the total variance is unique[13].

[13] The immunization rates may also be considered as an indicator of the health of individuals. We argue that the immunization rate is a policy variable and is targeted by the government (cf. Lake and Baum, 2001). However, we also did the factor analysis with the immunization rate in the factor analysis on the health of individuals. The correlation between the two factor scores on the health of individuals is 0.95 and between the factor scores on the health care sector 0.92. The results are available upon request.

Table 3.5 Correlation matrix: indicators of the health care sector

Correlations		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Number of physicians per 1,000 people	(1)	1.00	0.77	0.72	0.54	0.72	0.74	0.32	0.58	0.57	-0.14
Number of nurses per 1,000 people	(2)		1.00	0.60	0.46	0.64	0.82	0.27	0.50	0.48	-0.14
Number of dentists per 1,000 people	(3)			1.00	0.65	0.63	0.48	0.28	0.50	0.52	-0.11
Number of pharmacists per 1,000 people	(4)				1.00	0.55	0.39	0.12	0.43	0.40	-0.09
Births attended by skilled staff (% of total)	(5)					1.00	0.61	0.38	0.69	0.72	-0.05
Hospital beds per 1,000 people	(6)						1.00	0.22	0.45	0.43	-0.18
Immunization rate Hepatitis	(7)							1.00	0.55	0.61	0.13
Immunization rate DTP	(8)								1.00	0.93	0.12
Immunization rate Measles	(9)									1.00	0.14
Immunization rate Tuberculosis	(10										1.00

Table 3.6. Factor matrix quality of the health care sector

Indicator	Factor loading	Variance explained
Number of physicians per 1,000 people	0.875	0.77
Number of nurses per 1,000 people	0.803	0.64
Number of dentists per 1,000 people	0.751	0.56
Number of pharmacists per 1,000 people	0.614	0.38
Births attended by skilled staff (% of total)	0.847	0.72
Hospital beds per 1,000 people	0.751	0.56
Immunization rate Hepatitis	0.444	0.20
Immunization rate DTP	0.755	0.57
Immunization rate Measles	0.757	0.57
Immunization rate Tuberculosis	0.278	0.08

We construct new measures for the health of individuals and the health care sector based on the factor scores[14]. On the basis of these measures, we rank the countries in our sample. Table 3.7 summarizes the results. The rankings lead to a number of conclusions. First, not surprisingly, western countries and Japan dominate the top of the rankings, while mostly African countries take the positions at the bottom. Second, in

[14] The full list of the predicted factor scores and the implied ranking of the various countries can be found in Klomp and De Haan (2009b).

the ranking based on the health care sector Cuba and Belarus score remarkably high. Third, the ranking differs substantially from the most recent ranking on health over almost the same period by Nolte and McKee (2008) for OECD countries (which is shown in column (3) of Table 3.7). According to the results of Nolte and McKee (2008), France outranks all other countries in the OECD area. However, in our ranking France is at place eight in the ranking based on the health of individuals and is even number fourteen in the ranking based on the health care sector. Another example is Spain that takes the fourth place in the ranking of Nolte and McKee (2008), but is on place thirteen in our ranking of health services.

As rankings are not that informative without further information, Table 3.7 also presents the distance between each OECD country and the OECD mean[15]. This measure gives a much better impression about health differences between countries. The results show that there is a large difference between both health measures. While France scores about 2.5 percent higher in our measure for individual health, it scores about 11 percent below the mean for our health care measure. Nolte and McKee (2008) report that the United States scores about 27 percent below the mean. However, according to our measure of individual health, the United States scores only about 13 percent below the mean, while it scores above the mean according to our measure for health care sector. In general, Nolte and McKee (2008) report more dispersion compared to our measure for the health of individuals. However, the variance among the countries in our sample for our measure on health services is much higher than that of Nolte and McKee (2008). These results are confirmed if we take the standard deviation of the various measures divided by their mean.

Furthermore, if we expand our sample including not only the OECD countries, we find a similar, but even more pronounced, pattern. The data show that the differences between a country's score and the sample mean are much higher for the measure for the health care sector than they are for the measure for the health of individuals. The variance of the individual health measure is 1.1, while for the health services measure the variance is 2.4.

To sum up, our results indicate that there exist significant differences between our measures. The ranking based on the health of individuals is less dispersed than the ranking based on the quality of the health care sector. This strengthens our conclusions that both measures are capturing different dimensions of a country's

[15] The factor scores shown in Table 3 are in logarithms, meaning that in order to compute the dispersion or the variance we had to re-calculate them by taking the exponent.

health. So in contrast to Nolte and McKee (2008), we pose that cross-country comparisons of health should not be based on only one (arbitrarily chosen) variable.

Table 3.7 Health ranking of OECD countries

	Health of individuals ranking (1)				Health care sector ranking (2)				Health measure Nolte and McKee (2008) (3)		
	World	OECD	Factor score	Difference with mean	World	OECD	Factor score	Difference with mean	OECD	Mortality score	Difference with mean
Australia	6	4	1.237	6.78%	18	8	1.367	4.35%	3	71.32	17.60%
Austria	14	10	1.167	-0.44%	12	4	1.473	16.02%	11	84.48	2.40%
Canada	8	7	1.200	2.90%	38	18	0.957	-30.75%	6	76.83	11.24%
Denmark	23	16	1.087	-8.09%	24	13	1.281	-4.25%	15	100.84	-16.50%
Finland	20	14	1.143	-2.80%	19	9	1.353	2.90%	13	93.34	-7.84%
France	10	8	1.196	2.49%	27	15	1.203	-11.43%	1	64.79	25.15%
Germany	11	9	1.178	0.66%	16	7	1.391	6.89%	12	90.13	-4.13%
Greece	18	13	1.147	-2.41%	22	11	1.31	-1.43%	10	84.31	2.59%
Ireland	24	17	1.075	-9.19%	13	5	1.402	8.07%	17	103.42	-19.49%
Italy	5	3	1.252	8.39%	23	12	1.283	-4.05%	5	74.00	14.50%
Japan	1	1	1.357	20.40%	8	2	1.541	24.19%	2	71.17	17.77%
Netherlands	16	12	1.151	-2.02%	9	3	1.506	19.91%	8	81.86	5.42%
New Zealand	15	11	1.155	-1.63%	35	16	1.032	-25.35%	14	95.57	-10.42%
Norway	9	6	1.207	3.63%	4	1	1.781	57.87%	7	79.79	7.82%
Portugal	28	19	0.998	-15.92%	37	17	1.006	-27.27%	18	104.31	-20.51%
Spain	7	5	1.224	5.40%	26	14	1.206	-11.17%	4	73.83	14.70%
Sweden	2	2	1.280	11.47%	21	10	1.328	0.36%	9	82.09	5.16%
United Kingdom	21	15	1.101	-6.80%	39	19	0.936	-32.19%	16	102.81	-18.78%
United States of America	25	18	1.034	-12.84%	15	6	1.395	7.32%	19	109.65	-26.68%
Standard deviation			0.087				0.217			0.154	

Note: because our factor scores are in logarithms we subtracted the value of a country from that of the value for country with the highest score to obtain the difference in percentage. The factor score are computed in logarithms.

3.3 Political factors and health

We identify three dimensions of the political regime in place that may influence health: 1) the type of regime and 2) the stability of the political system and 3) government governance.

Besley and Kudamatsu (2006) argue that the *type of regime* influences the quality of health in various ways. Democracies will spend more on health since autocracies generally rely on the rich, who care less about public spending on health than the poor or middle classes. In a similar vein, Sen (1999) argues that democracies allow the poor, who generally suffer from poor health, to penalize governments through the electoral process. In the model of Meltzer and Richard (1981), expanding suffrage implies that the position of the median voter—whose preferences determine government policy in the model—shifts down the income distribution. However, when income is unequally distributed, the median income is less than the mean income and therefore the median voter favours more economic redistribution, for instance in the form of better access to health care for the poor (Ross, 2006). Note that these arguments implicitly refer to government spending on health. However, in a similar way it can be argued that democracy has a direct positive effect on health as it may lead to more efficient provision of health care. Voters will punish politicians who are responsible for corrupt and poorly managed health care systems. Political institutions might also affect health through their impact on health policy issues, such as universal access to high-quality services.

Various cross-country or panel studies examine the relationship between democracy and health outcomes. Most of them find a positive relationship between democracy and various health indicators (see Table A3.1). However, the effects reported are not always robust. For example, when the random effects model of Zweifel and Navia (2000) is re-estimated with fixed effects, the influence of regime type on infant mortality drops sharply in size and statistical significance (Pande, 2003).

The second dimension of political institutions that we distinguish is the *stability of the political system* in place. Individuals and governments are more willing to invest in health if the political environment is stable. Furthermore, political instability caused by riots, civil war or strikes (in particular of the medical staff) can disrupt the health system in a country. The general finding in empirical studies is that political instability is negatively related to health.

The final dimension that we distinguish is *governance*. One popular view spread around the world by the World Bank and the IMF during the last decade is

that good governance may increase health. For example, if there is much corruption and/or an inefficient bureaucracy, the allocation of the health budget may be distorted and health aid programs may not reach their target groups. Likewise, the recent UK government's Report on the Commission for Africa places a premium on governance in bolstering development prospects in the region, and the US government's Millennium Challenge Corporation expects to spend billions of dollars on countries that demonstrate good governance. It is widely believed that the problem of lack of basic governance principles in health care is that well-intentioned spending may have no impact. Priorities cannot be met if institutions don't function and scarce resources are wasted due to bribes, corrupt officials and mis-procurement (Lewis, 2006). This is confirmed, for example, by Menon-Johansson (2005) and Reidpath and Allotey (2006). Both studies find a strong link between poor governance and the quality of health using the World Bank governance indicators.

3.4 Empirical model

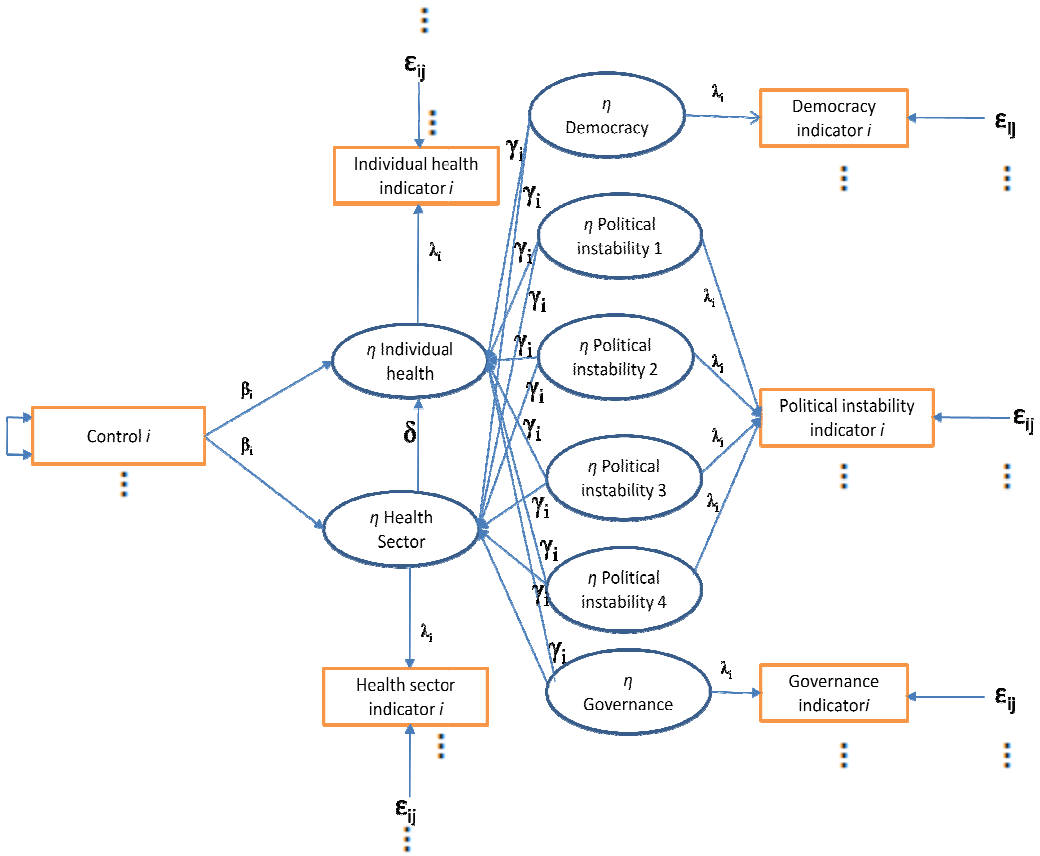
As both the dependent variable, i.e., health of individuals, and some of the explanatory variables (i.e., political instability, democracy, governance, and the quality of the health care system) are latent variables we use Structural Equation Modelling as suggested by Wansbeek and Meijer (2000). Using the factor scores from the static factor analysis found in Chapter 2 as a regressor in a model, leads to inconsistent estimation results because the latent variable is imperfectly measured (see also De Haan *et al.*, 2003). Alternatively, we use a structural equation model, which allows for explicitly capturing the measurement error within the latent construct and consistently estimating the relation between them. Structural equation modelling combines factor analysis and regression analysis, we take the number of dimensions that represent individual health and the quality of the health care system from the factor analysis above. From Chapter 2, we take the dimensions from the static factor analysis of democracy, political instability, and governance.

Figure 3.3 explains the model. Here unobservable η variables are enclosed in circles and the observed variables are represented by rectangles, while the error terms are represented by ε. The arrows leading from the latent variables to the observed variables indicate the hypothesized effect. The strength of the effects is indicated by λ_i.

The arrows leading from η to the two health indicators (γ_i) represent the hypothesized impact of the latent political variables on the health sector and the indi-

vidual health, while parameter β_i represents the effect of the control variables on the two latent health variables.

Figure 3.3. Path diagram structural equation model



In the figure, *individual health* is our measure for the latent construct individual health and *health sector* is our measure for the latent construct quality of the health care sector. We expect a positive relationship between the quality of the health care sector and individual health as represented by δ[16].

The vector *control* contains socio-economic control variables that have been suggested in previous studies to affect health of individuals. These include the level and distribution of income (Bloom and Canning, 2005; Franco *et al.*, 2004; Rodgers,

[16] The model is estimated with AMOS 7.0 using the maximum likelihood estimation. We do not report the results on the measurement part λ_i of the structural equation model. All indicators of democracy, governance and political instability are significant and our findings are very similar to those of the factor analysis as presented in Chapter 2. The results are available upon request.

2002). Furthermore, we add education (proxied by the primary and secondary enrolment rate) as suggested by Ross and Wu (1995); investment (Bloom and Canning, 2000); the share of the population living in rural areas; total population; fertility rate; trade openness (Owen and Wu, 2007); aid (Owen and Wu, 2007), and public and private spending on health (Or, 2001; Elola *et al.,* 1995).

Next we include some variables on life circumstances (improved water and sanitary facilities, CO2 emission per capita, and the food production index), and life style (tobacco use and alcohol use). Also the climate in a country is a potential determinant of health. For example, some diseases—like malaria—can only develop in a hot climate. We represent climate with a latitude variable, which is measured as the distance to the equator, and the average temperature in a country. We also include the share of government expenditure of GDP (excluding public health expenditure). The reason is that not only public spending on health can increase the health of individuals but also other types of government spending, like special programs that relief poverty or that make people better aware of healthy food. Finally, we take up two additional demographic variables: the dependency ratio and the share of women in the total population. The control variables are all measured as averages over the period 1980 to 1999. Table A3.3 in Appendix A3 gives a detailed description of the data used in the structural equation model. All control variables may affect individual health and/or the quality of the health care sector. The arrows from and to *control* in Figure 3.3 indicate that the various control variables may be correlated. We also add country group effects to the model, as suggested by Pande (2003).

3.5 Estimation results

3.5.1 Basic model

We take the structural equation model without the political variables but with all potential control variables as our starting point for the general-to-specific approach. In this approach, the modeller simplifies an initially general model that adequately characterizes the empirical evidence within the theoretical framework used. This method has proved useful in practice for selecting empirical economic models (Campos *et al.*, 2004). In almost all previous studies on the relationship between health and political variables that we are aware of, models have been selected on an ad-hoc basis, making them suspect to an omitted variables problem.

We take the results as our baseline model that is shown in columns (1) and (2) of Table 3.8. The overall fit of the base model is very good. The Chi-squared statistic, which is a test statistic that compares the proposed model to an unrestricted alternative (saturated model), lies well below the 5 percent critical value. The norm fit index (NFI), has a value of about 0.84, while the comparative fit index (CFI) is about 0.87.

Income is significantly related to the health of individuals and also to the health care sector, while the distribution of income has a negative relationship with individual health. Also education has a significant positive relationship with the health of individuals. Two demographic variables (the share of the population living in rural areas and the fertility rate) have a significant negative link with the health care sector; the former is also related to the health of individuals. Public health expenditure has a significant positive relationship with the quality of the health care sector. Finally, it turns out that the quality of the health care sector has a positive link with individual health.

In the model shown in columns (3) and (4) of Table 3.8, we add our democracy indicator. The results show that democracy has a significant positive relationship with the health of individuals, but no significant relationship with the health care sector. If our results could be interpreted as a causal relationship, a topic to which we return in section 3.5.4., they imply that when democracy increases by one percent, the health of individuals improves 0.13 percent. Although the effect is significant, it is also quite small.

Next, we add the four dimensions of political instability to the baseline regression (columns (5) and (6) of Table 3.8). Our measures for protest and aggression are not related to the health of individuals and the health care sector. In contrast, we find that regime instability has a negative link with the health of individuals, while government instability has an indirect link with the health of individuals through its negative relationship with the quality of the health care sector.

Finally, when we add our governance indicators to the base model (columns (7) and (8) of Table 3.8), it turns out that governance does not directly affect the health of individuals, but has a positive effect on the health care sector. A 1 percent increase in governance leads to an increase of 0.28 percent in the quality of the health care sector and an increase in the health of individuals of about 0.23 percent.

3.5.2. Sensitivity analysis

In the regressions in Table 3.8 we assumed that the political institutions have a homogenous impact across countries. However, there is a possibility that coefficients differ across countries due to heterogeneity. Therefore, we re-estimated the regressions (3)-(8) of Table 3.8 with the random sample method, replicating the regressions 1,000 times by estimating it with a randomly changing sample of countries covering 40 percent of the sample. As Table 3.9 shows, we still find a significant relationship between democracy and regime instability and the health of individuals, while government stability has an indirect link with individual health through the quality of the health care sector.

As a second robustness test we split the sample into industrialized countries and emerging markets and developing countries. The results indicate that democracy and regime instability are significant determinants of individual health in developing countries, while governance and government instability are significant determinants of the health care sector in industrialized countries.

3.5.3 Indirect effects

So far, we have examined the direct relationship between various dimensions of the political regime in place and individual health and the quality of the health care sector. However, our political variables may also have an indirect effect on health, for example through their impact on income per capita. To test this hypothesis, we have estimated a model with three equations (Table 3.10). The results for individual health and the health care sector are similar to the findings reported in Table 3.8. As for income per capita, we find that secondary education, the fertility rate, and investment are significantly related to income. When we add democracy, we find a significant relationship between democracy and income. So democracy also indirectly affects health through income per capita. Our different measures for political instability have no effect on income per capita.

Finally, we find that governance not only has an indirect impact on health via its influence on the health care sector, but also via its positive impact on income per capita. A 1 percent increase in governance leads to an increase of 0.55 percent in the quality of the health sector and an increase in the health of individuals of about 3.54 percent. This result shows that the indirect effect through income per capita is the most important channel through which governance can help improving health, because the impact is larger than the direct effect.

Table 3.8 Estimation results I - structural equation model I

	Health of individuals	Health sector	Health of individuals	Health sector	Health of individuals	Health sector	Health of individuals	Health sector
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Initial income per capita	5.092	0.467	5.136	0.453	4.703	0.418	4.337**	0.375**
	[3.34]**	[6.02] **	[3.53] **	[5.61] **	[3.67] **	[6.15] **	[2.79] **	[5.78] **
Income inequality	-2.852		-2.850		-2.582		-2.647**	
	[-2.68]		[-2.57] **		[-2.81] **		[-2.32] *	
Secondary school enrolment	6.176		5.314		6.024		5.150*	
	[1.92] *		[2.17] **		[1.90] *		[1.81] *	
Fertility rate		-0.087		-0.087		-0.101		-0.080**
		[-2.12] **		[-2.20] **		[-2.26] **		[-2.01] **
Rural population	-0.013	-0.172	-0.014	-0.171	-0.013	-0.185	-0.012**	-0.162**
	[-2.15] **	[-2.46] **	[-2.06] **	[-2.68] **	[-2.10] **	[-2.56] **	[-2.02] **	[-2.12] **
Public health expenditure		1.027		1.036		1.122		0.894**
		[3.09] **		[3.08] **		[2.83] **		[3.06] **
Quality of the health sector	0.953		1.020		0.992		0.812**	
	[4.86] **		[4.76] **		[5.38] **		[4.53] **	
Democracy			0.127	0.270				
			[2.30]**	[1.28]				
Instability: aggression					-0.094	-0.111		
					[-1.28]	[-1.51]		
Instability: protest					-0.094	-0.012		
					[-1.10]	[-1.07]		

Instability: regime			-0.093	-0.059	
			[-1.97]**	[-0.83]	
Instability: government			-0.117	-0.127	
			[-1.45]	[-2.01]**	
Governance					0.078 0.279**
					[1.02] [2.02] **
Number observations	135	129	121		101
R-squared	0.78	0.82	0.79		0.80
Chi-squared p-value	0.000	0.000	0.000		3035.60
NFI	0.82	0.85	0.83		0.84
CFI	0.87	0.88	0.85		0.88

*Notes: ** indicates significance at a 5 percent level, and * means significance at a 10 percent level. The model is estimated with country group effects.*

Table 3.9 Robustness test

	Random sample		Developing		Developed	
	Individual health	Health sector	Individual health	Health sector	Individual health	Health sector
Democracy	0.138	0.254	0.149	0.342	0.130	0.240
	[2.19]**	[1.41]	[3.02] **	[1.33]	[1.47]	[1.32]
Governance	0.085	0.281	0.119	0.324	0.077	0.230
	[1.04]	[1.94] **	[1.44]	[1.52]	[0.60]	[2.24] **
Instability: aggression	-0.099	-0.119	-0.126	-0.141	-0.082	-0.090
	[-1.12]	[-1.51]	[-1.19]	[-1.52]	[-0.90]	[-1.47]
Instability: protest	-0.088	-0.011	-0.092	-0.016	-0.078	-0.009
	[-1.03]	[-1.17]	[-1.29]	[-1.56]	[-0.60]	[-0.85]
Instability: regime	-0.094	-0.060	-0.136	-0.063	-0.067	-0.055
	[-1.91] *	[-0.90]	[-2.17] **	[-0.61]	[-1.32]	[-0.59]
Instability: government	-0.115	-0.120	-0.139	-0.147	-0.082	-0.093
	[-1.63]	[-1.97] **	[-1.64]	[-1.44]	[-0.87]	[-2.43]**

*Notes: ** indicates significance at a 5 percent level, and * means significance at a 10 percent level. The model is estimated with country group effects.*

Table 3.10 Estimation results II - structural equation model II (with effect on income per capita)

	Health of individuals	Health sector	Income per capita	Health of individuals	Health sector	Income per capita	Health of individuals	Health sector	Income per capita	Health of individuals	Health sector	Income per capita
	(1)	(2)	(3)	(4)	(5)	(6)	(10)	(11)	(12)	(13)	(14)	(15)
Income per capita	5.323	0.389		5.621	0.411		5.329	0.411		4.949	0.449	
	[3.38]**	[7.26]**		[3.17]**	[6.84]**		[3.16]**	[7.62]**		[3.25]**	[6.11]**	
Income inequality	-3.436			-3.410			-3.358			-2.776		
	[-2.86]**			[-2.84]**			[-3.09]**			[-2.51]**		
Secondary school enrolment	6.622		0.907	6.261		0.869	6.830		0.863	5.651*		0.803
	[2.47]**		[3.15]**	[2.71]**		[2.92]**	[2.53]**		[2.96]**	[1.89]*		[2.64]**
Fertility rate		-0.111	-0.318		-0.107	-0.312		-0.108	-0.323		-0.093	-0.299
		[-2.47]**	[-1.83]**		[-2.57]**	[-1.77]**		[-2.43]**	[-1.81]		[-2.16]	[-2.23]**
Rural population	-0.012	-0.186		-0.013	-0.204		-0.014	-0.202		-0.014	-0.186	-0.433
	[-2.38]**	[-2.69]**		[-2.40]**	[-2.79]**		[-2.60]**	[-2.88]**		[-2.23]**	[-2.54]	[-3.07]**
Public health expenditure		1.183			1.085			1.058			1.069	
		[3.56]**			[3.87]**			[3.82]**			[3.67]**	
Quality of the health sector	0.908			0.928			0.770			0.922		
	[5.79]**			[5.56]**			[6.19]**			[5.04]**		
Investment			0.223			0.234			0.232			0.208
			[2.20]**			[2.01]**			[2.11]**			[2.15]**
Democracy				0.107	0.241	0.677						
				[2.03]**	[1.25]	[2.22]**						
Instability: aggression							-0.080	-0.103	-0.134			
							[-1.28]	[-1.54]	[-1.65]			
Instability: protest							-0.082	-0.011	0.025			
							[-1.04]	[-0.61]	[0.29]			

Instability: regime			-0.079	-0.057	0.515			
			[-2.03]**	[-0.74]	[1.54]			
Instability: government			-0.836	-0.125	0.125			
			[-1.25]	[-	[1.35]			
Governance						0.096	0.274*	0.612
						[1.19]	[2.39]**	[3.29]**
Number observations	135	129	121			101		
R-squared	0.81	0.88	0.84			0.88		
Chi-squared p-value	0.000	0.000	0.000			2904.14		
NFI	0.79	0.89	0.81			0.79		
CFI	0.89	0.84	0.93			0.95		

Notes: ** *indicates significance at a 5 percent level, and * means significance at a 10 percent level. The model is estimated with country group effects.*

We also tested for an indirect effect of our political variables through income distribution, health expenditure, and education, but when the indirect effect of income is included these other indirect effects are all insignificant. The results are available upon request.

3.5.4 Discussion

Our results are based on factor analysis and structural equation modeling and in this respect our study differs from all previous research that we are aware of. So as a minimum, our results can be interpreted as an addition to the extant literature and a triangulation of the results reported so far. An important advantage of our approach is that it allows employing multiple indicators for each underlying latent construct such as health, democracy, governance, and political instability. Furthermore, a structural equation model allows modeling rather complex interrelationships among various variables. At the same time, a disadvantage is that the method is exploratory rather than confirmatory. So, in general, causality is hard to establish. This, of course, is true for most cross-country studies. In an attempt to deal with this problem, we measured health over the period 2000 to 2005, while our political and control variables refer to the period 1980 to 1999. As it is highly unlikely that health over the period 2000 to 2005 affects our political variables as measured over 1980-1999, we are inclined to interpret our findings as causal.

We have a large sample of countries, which makes our analysis less vulnerable to the critique of Ross (2006). However, as some control variables are missing for some developing countries, the sample of countries used in the regression analysis is somewhat smaller. To examine whether there are systematic differences between developing countries included in the regression and those excluded, we have calculated the average, the median, and the standard deviation for our political and health variables for both samples. The results show that the mean, the median, and the standard deviation of the countries excluded because of missing data are comparable to the figures for the developing countries included (results are available upon request). We have also calculated the correlation of our health variables and our political variables, again for all developing countries included in our regressions and those excluded. The correlations are very similar across both samples, suggesting that our results are not driven by the exclusion of countries for which data on controls are missing.

In addition, we have estimated data for the missing variables using the expectation-maximization (EM), suggested by Dempster *et al.,* (1977) to solve maximum likelihood problems with missing data, and re-estimated the structural equation model. Again, we find that democracy and regime instability are significantly related to the health of individuals, while government instability is significantly related to the quality of the health care sector. The results are available on request.

3.6 Conclusion

We examined the relationship between political institutions and health using a structural equation model with various economic and demographic control variables. Our results can be interpreted as an addition to the extant literature and a triangulation of the results reported so far. At the same time, we have tried to avoid many of the shortcomings of previous studies. First, we have considered a very long list of potential control variables that have all been argued being related to health. Second, the specification of our model is determined by the general-to-specific approach, whereas in most previous research model specification is based on ad-hoc assumptions. Third, we carefully check how sensitive our results are for our sample of countries. Not only do we come up with a much bigger sample than most previous studies, we also check for the robustness of our findings for randomly changing samples. All our results consistently suggest that democracy has a positive relationship with individual health, while regime instability has a negative relationship with the health of individuals. Government instability is also negatively related to individual health via its link with the quality of the health care sector, while democracy is positively related with individual health through its link with income.

Furthermore, our results suggest that government governance is not directly related to the health of individuals once economic and demographic control variables are included. Indirectly, however, governance influences health via its positive impact on income and the quality of the health care sector.

Appendix A3

Table A3.1 Empirical studies on health and political institutions

Authors	Health indicator	Control variables	Political dimension	Method
Lena and London (1993)	Life expectancy	Income, investment, international economic factors	Democracy, s, + political colour (left) s, +	Cross-country
Frey and Al Roumi (1999)	Physical quality of life	Energy consumption, trade, state intervention, population growth	Democracy (+, s)	Panel
Zweifel and Navia (2000)	Mortality rate	Population, education, trade, labour force	Democracy +,s	Panel
Lake and Baum (2001)	Mortality rate	Income, population, urbanization	Democracy +,s	Panel
Shin (2002)	Life expectancy	Income, inequality	Democracy (+, s)	Cross-country
Navarro *et al,* (2003)	Mortality rate	Power relations, Labour market, economic inequality	Democracy +, s	Cross country
Navia and Zweifel (2003)	Mortality rate	Population, education, trade, labour force	Democracy +,s	Panel
Pande (2003)	Mortality rate	Population, education, trade, labor force	Democracy +,s	Panel
Franco *et al.* (2004)	Life expectancy, mortality	Income, inequality, government size	Democracy (+, s)	Cross-country
Shandra *et al,* (2004)	Infant mortality	Income, education	Democracy ns,-	Cross country
Ghobarah *et al,* (2004a)	Public and total health expenditure and healthy life expectance	Income, inequality, education	Democracy +, s, Civil war -,s	Cross country
Ghobarah *et al,* (2004b)	Healthy Life expectancy	Urbanization, education, government expenditure	Civil war -, s	Cross country
Houweling *et al,* (2005)	Under-5 mortality rate	Income, public spending, literacy	Democracy ns,-	Cross-country
Li and Wen (2005)	Mortality rate	Inequality, urbanization, income	Democracy +, s/ns Armed conflict -, s	Panel
McGuire (2005)	Mortality rate	Inequality, education, income	Democracy -, ns	Cross-country
Besley and Kudamatsu (2006)	Life expectancy	Income, education	Democracy +,s, Political instability -,s	Panel
Gerring *et al,* (2006)	Mortality rate	Income, urbanization	Democracy -,s political instability -,s	Panel
Iqbal (2006)	Healthy Life Expectancy	Income, openness, population	Democracy ns,+ Conflict ns/s,-	Panel
Navarro *et al,* (2006)	Mortality rate, Life expectancy	Power relations, Labour market, economic inequality	Democracy +, s	Cross country
Reidpath and Allotey (2006)	Healthy Life expectancy	Income	Governance +,s	Cross-country

Ross (2006)	Mortality rate	Income, population density, economic growth	Democracy (+, s), Regime change (-, s	Panel
Safaei (2006)	Mortality and life expectancy	Income, investment, international economic factors	Democracy +, s	Cross country

Notes: + and – indicate the sign of the political regime indicator in the regression, while s and ns indicate whether the variable is significant or not.

Table A3.2 Countries included in the factor analyses on health

Afghanistan	Cyprus	Kyrgyzstan	Russian Federation
Albania	Czech Republic	Lao PDR	Rwanda
Algeria	Denmark	Latvia	Saudi Arabia
Antigua and Barbuda	Djibouti	Lebanon	Senegal
Argentina	Dominican Republic	Lesotho	Serbia and Montenegro
Armenia	DPR Korea	Liberia	Sierra Leone
Australia	Ecuador	Libya	Singapore
Austria	Egypt	Lithuania	Slovakia
Azerbaijan	El Salvador	Luxembourg	Slovenia
Bahamas	Equatorial Guinea	Macedonia	Solomon Islands
Bahrain	Eritrea	Madagascar	Somalia
Bangladesh	Estonia	Malawi	South Africa
Barbados	Ethiopia	Malaysia	Spain
Belarus	Fiji	Maldives	Sri Lanka
Belgium	Finland	Mali	Sudan
Belize	France	Malta	Suriname
Benin	Gabon	Mauritania	Swaziland
Bhutan	Gambia	Mauritius	Sweden
Bolivia	Georgia	Mexico	Switzerland
Bosnia and Herzegovina	Germany	Moldova	Syrian Arab Republic
Botswana	Ghana	Mongolia	Tajikistan
Brazil	Greece	Morocco	Tanzania
Brunei Darussalam	Guatemala	Mozambique	Thailand
Bulgaria	Guinea	Namibia	Timor-Leste
Burkina Faso	Guinea-Bissau	Nepal	Togo
Burma	Guyana	Netherlands	Trinidad and Tobago
Burundi	Haiti	New Zealand	Tunisia
Cambodia	Honduras	Nicaragua	Turkey
Cameroon	Hungary	Niger	Turkmenistan
Canada	Iceland	Nigeria	Uganda
Cape Verde	India	Norway	Ukraine
Central African Republic	Indonesia	Oman	United Arab Emirates
Chad	Iran (Islamic Republic of)	Pakistan	United Kingdom
Chile	Iraq	Panama	United States of America
China	Ireland	Papua New Guinea	Uruguay
Colombia	Israel	Paraguay	Uzbekistan
Comoros	Italy	Peru	Vanuatu
Congo (Brazzaville)	Jamaica	Philippines	Venezuela
Congo (Kinshasa)	Japan	Poland	Viet Nam
Costa Rica	Jordan	Portugal	Yemen

Côte d'Ivoire	Kazakhstan	Qatar	Zambia
Croatia	Kenya	Republic of Korea	Zimbabwe
Cuba	Kuwait	Romania	

Table A3.3 Data used in regressions as control variables

Variable	Definition	Source
Aid (% GDP)	Includes both official development assistance (ODA) and official aid.	World Bank (2006)
Age dependency ratio	The ratio of dependents (people younger than 15 or older than 64) to the working-age population.	World Bank (2006)
Alcohol use	The use of alcohol (litres per person).	WHO (2006)
CO2 emission	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement.	World Bank (2006)
Government spending (% GDP)	All government current expenditures for purchases of goods and services (including compensation of employees) corrected for public health expenditure.	World Bank (2006)
Female population	Percentage of the population that is female.	World Bank (2006)
Fertility rate	Number of newborns per woman.	World Bank (2006)
Improved water facilities	The percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection.	World Bank (2006)
Improved sanitary facilities	The percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta.	World Bank (2006)
Income inequality	Income distribution measure.	The University of Texas Inequality Project (2005)
Income	The sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products on 1980 (in constant 2000 U.S. dollars).	World Bank (2006)
Investment (% GDP)	Includes land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, and the like.	World Bank (2006)
Latitude	Distance to the equator.	CIA (2005)
Openness (% GDP)	The sum of exports and imports of goods and services.	World Bank (2006)
Population	All residents regardless of legal status or citizenship who are generally considered part of the population of their country of origin.	World Bank (2006)

Private health spending (% GDP)	Private health expenditure (includes direct household (out-of-pocket) spending, private insurance, charitable donations, and direct service payments by private corporations).	WHO (2006) and World Bank (2006)
Public health spending (% GDP)	Public health expenditure consists of recurrent and capital spending from government budgets, external borrowings and grants and social health insurance funds.	WHO (2006) and World Bank (2006)
Rural population	Difference between the total population and the urban population.	World Bank (2006)
Primary school enrolment	Ratio of total enrolment to the population of the age group that officially corresponds to the level of education shown.	World Bank (2006)
Secondary school enrolment	Ratio of total enrolment to the population of the age group that officially corresponds to the level of education shown.	World Bank (2006)
Temperature	Average temperature.	World Bank (2006)
Tobacco	The use of tobacco (kg per person).	WHO (2006)

All variables shown are included in the initial set of variables used to come up with our preferred model using the general-to-specific approach as shown in columns (1) and (2) of Table 3.8.